CLAIMS

What is claimed is:

1. A signal filter device comprising:

an infinite impulse response (IIR) notch filter configured to receive a first input signal and provide an output signal; and

a controller coupled to the notch filter to receive the output signal and provide a second input signal to the notch filter to adaptively control the null frequency of the notch filter.

2. The signal filter device of claim 1 wherein the IIR notch filter is a constrained IIR notch filter.

3. The signal filter device of claim 1 wherein the IIR notch filter is a second order IIR notch filter.

4. The signal filter device of claim 1 wherein the notch filter removes a particular frequency band from the first input signal and provides the remaining signal as the output signal.

5. The signal filter device of claim 4 wherein the first input signal is a wideband signal and the frequency band removed is a narrow frequency band.

6. The signal filter device of claim 4 wherein the frequency band removed corresponds to signal interference.

7. The signal filter device of claim 1 wherein the notch filter requires no external reference signal.

8. The signal filter device of claim 1 wherein the controller is configured to minimize the power of the output signal of the notch filter by controlling the null frequency of the notch filter.

9. The signal filter device of claim 8 wherein controller minimizes the power of the output signal by modifying the second input signal according to a gradient-based algorithm.

10. The signal filter device of claim 9 wherein the gradient-based algorithm is a recursive prediction error algorithm.

11. The signal filter device of claim 9 wherein the gradient-based algorithm is a pseudolinear regression algorithm.

12. The signal filter device of claim 9 wherein the second input signal is based on the output signal and the derivative of the output signal with respect to the second input signal.

13. The signal filter device of claim 1 wherein the signal filter has the z-domain transfer function

$$H(z) = a\frac{1 + k_1 k_2 h[n] k_5 z^{-1} + z^{-2}}{1 - a k_1 k_2 k_3 h[n] k_5 z^{-1} - a k_4 z^{-2}}$$

where the terms a, k1, k2, k3, k4, and k5 are the filter parameters and absorbing scaling factors and h[n] is the second input signal.

14. The signal filter device of claim 1 wherein the received signal contains a dominant interference narrowband.

15. A communication device comprising:

a receiving module including,

an infinite impulse response (IIR) notch filter configured to receive a first input signal and provide an output signal; and

a controller coupled to the notch filter to receive the output signal and provide a second input signal to the notch filter to adaptively control the null frequency of the notch filter.

16. The communication device of claim 15 wherein the IIR notch filter is a constrained IIR notch filter.

17. The communication device of claim 15 wherein the IIR notch filter is a second order IIR notch filter.

18. The communication device of claim 15 wherein the first input signal is a wideband signal.

19. The communication device of claim 15 wherein the notch filter removes a particular frequency band from the first input signal and provides the remaining signal as the output signal.

20. The communication device of claim 19 wherein the frequency band removed corresponds to narrowband signal interference.

21. The communication device of claim 19 wherein the received signal contains a dominant interference narrowband.

22. The communication device of claim 15 wherein the controller is configured to minimize the power of the output signal of the notch filter.

23. The communication device of claim 22 wherein minimizing the power of the output signal of the notch filter causes narrowband interference to be removed from the first input signal.

24. The communication device of claim 22 wherein the controller minimizes the power of the output signal by varying the second input signal according to a gradient-based algorithm.

25. The communication device of claim 24 wherein the gradient-based algorithm is a recursive prediction error algorithm.

26. The communication device of claim 24 wherein the gradient-based algorithm is a pseudolinear regression algorithm.

27. The communication device of claim 15 wherein the second input signal is based on the output signal and the derivative of the output signal with respect to the second input signal.

28. The communication device of claim 15 wherein the notch filter has the z-domain transfer function

$$H(z) = a\frac{1 + k_1 k_2 h[n] k_5 z^{-1} + z^{-2}}{1 - a k_1 k_2 k_3 h[n] k_5 z^{-1} - a k_4 z^{-2}}$$

where the terms a, k1, k2, k3, k4, and k5 are the filter parameters and absorbing scaling factors and h[n] is the second input signal.

29. A method for filtering signal interference comprising:

filtering a received signal to remove interference and provide an output signal; and

dynamically minimizing the power of the output signal by removing a frequency band.

30. The method of claim 29 wherein the filtering is accomplished by a notch filter.

31. The method of claim 30 wherein minimizing the power of the output signal by removing a frequency band from the received signal is accomplished by modifying the null frequency of the notch filter to correspond with the highest power frequency band in the received signal.

32. The method of claim 30 wherein the notch filter has the z-domain transfer function

$$H(z) = a\frac{1 + k_1 k_2 h[n] k_5 z^{-1} + z^{-2}}{1 - a k_1 k_2 k_3 h[n] k_5 z^{-1} - a k_4 z^{-2}}$$

where the terms a, k1, k2, k3, k4, and k5 are the filter parameters and absorbing scaling factors and h[n] is an adaptation input signal for the notch filter.

33. The method of claim 29 wherein the filtering is accomplished by a constrained IIR notch filter.

34. The method of claim 29 wherein the filtering is accomplished by a second order IIR notch filter.

35. The method of claim 29 wherein the received signal is a wideband signal and the removed frequency band is a narrow frequency band.

36. The method of claim 29 wherein the removed frequency band corresponds to signal interference.

37. The method of claim 29 wherein the received signal contains a dominant interference narrowband.

38. The method of claim 29 wherein minimization of the output signal power results from the detection of the output signal power.

39. The method of claim 29 wherein the minimization of the power of the output signal is accomplished according to a gradient-based algorithm.

40. The method of claim 39 wherein the gradient-based algorithm is a recursive prediction error algorithm.

41. The method of claim 39 wherein the gradient-based algorithm is a pseudolinear regression algorithm.

42. A machine-readable medium having one or more instructions for adaptively filtering signal interference,

which when executed by a processor, causes the processor to perform operations comprising:

receiving a first signal;

filtering the first signal to remove interference and provide an output signal; and

minimizing the power of the output signal by removing a frequency band from the first signal.

43. The machine-readable medium of claim 42 wherein the filtering is accomplished by a notch filter.

44. The machine-readable medium of claim 43 wherein the minimizing the power of the output signal by removing a frequency band from the first signal is accomplished by modifying the null frequency of the notch filter to correspond with the highest power frequency band in the first signal.

45. The machine-readable medium of claim 43 wherein the notch filter has the z-domain transfer function

$$H(z) = a\frac{1 + k_1 k_2 h[n] k_5 z^{-1} + z^{-2}}{1 - a k_1 k_2 k_3 h[n] k_5 z^{-1} - a k_4 z^{-2}}$$

where the terms a, k1, k2, k3, k4, and k5 are the filter parameters and absorbing scaling factors and h[n] is a second adaptation input signal for the notch filter.

46. The machine-readable medium of claim 42 wherein the filtering is accomplished by a constrained infinite impulse response notch filter.

47. The machine-readable medium of claim 42 wherein the filtering is accomplished by a second order infinite impulse response notch filter.

48. The machine-readable medium of claim 42 wherein the first signal is a wideband signal and the removed frequency band is a narrow frequency band.

49. The machine-readable medium of claim 42 wherein the removed frequency band corresponds to signal interference.

50. The machine-readable medium of claim 42 wherein the first signal contains a dominant interference narrowband.

51. The machine-readable medium of claim 42 wherein minimization of the output signal power is based on the detection of the output signal power.

52. The machine-readable medium of claim 42 wherein the minimization of the power of the output signal is accomplished according to a gradient-based algorithm.

53. The machine-readable medium of claim 52 wherein the gradient-based algorithm is a recursive prediction error algorithm.

54. The machine-readable medium of claim 52 wherein the gradient-based algorithm is a pseudolinear regression algorithm.

55. A system for adaptively filtering signal interference comprising:

means for filtering a first signal to remove interference and provide a second signal; and

means for minimizing the power of the second signal by removing a frequency band from the first signal.

56. The system of claim 55 wherein the means for filtering includes a notch filter.

57. The system of claim 56 wherein the means for minimizing the power of the output signal by removing a frequency band from the first signal is accomplished by modifying the null frequency of the notch filter to correspond with the highest power frequency band in the first signal.

58. The system of claim 56 wherein the notch filter has the z-domain transfer function

$$H(z) = a\frac{1 + k_1 k_2 h[n] k_5 z^{-1} + z^{-2}}{1 - a k_1 k_2 k_3 h[n] k_5 z^{-1} - a k_4 z^{-2}}$$

where the terms a, k1, k2, k3, k4, and k5 are the filter parameters and absorbing scaling factors and h[n] is an adaptation input signal for the notch filter.

59. The system of claim 55 wherein the means for filtering includes a constrained infinite impulse response notch filter.

60. The system of claim 55 wherein the means for filtering includes a second order infinite impulse response notch filter.

61. The system of claim 55 wherein the first signal is a wideband signal and the removed frequency band is a narrow frequency band.

62. The system of claim 55 wherein the removed frequency band corresponds to signal interference.

63. The system of claim 55 wherein minimization of the output signal power results from the detection of the output signal power.

64. The system of claim 55 wherein the minimization of the power of the output signal is accomplished according to a gradient-based algorithm.

65. The system of claim 64 wherein the gradient-based algorithm is a recursive prediction error algorithm.

66. The system of claim 64 wherein the gradient-based algorithm is a pseudolinear regression algorithm.